Sleep efficiency and electroencephalographic patterns in midlife are associated with cognitive change over the adult life course

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Published in:
Journal of Sleep Research

Publication date:
2018

Document Version
Publisher's PDF, also known as Version of record

O194 | Sleep efficiency and electroencephalographic patterns in midlife are associated with cognitive change over the adult life course

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Objectives/Introduction: Disrupted sleep is a contributing factor to cognitive aging, while also being associated with major neurodegenerative disorders. Little is known, however, about the relation of sleep and the gradual positive or negative cognitive changes over the adult life course. Patterns in the sleep electroencephalogram (EEG) are potential markers of the cognitive progress.

Methods: To test this hypothesis, we assessed the sleep architecture and sleep EEG of 167 men born in the Copenhagen Metropolitan Area in 1953, who – based on individual cognitive testing from early (~18 years) to late adulthood (~58 years) – were divided in 85 subjects with negative and 82 with positive cognitive change over their adult age span. As part of a Center for Healthy Aging (University of Copenhagen) study, participants underwent standard polysomnography including manual sleep scoring between 2009 and 2013. Features of sleep stage distribution were combined with a number of EEG features to distinguish between the two groups: EEG rhythmicity was assessed by spectral power analysis in frontal, central and occipital scalp sites. Functional connectivity was measured by inter-hemispheric EEG coherence. Group-differences were assessed by analysis of covariance ($p < 0.05$) including completed level of formal education as covariate. Significant features were combined in a machine learning approach to estimate their discriminative usability.

Results: Subjects with cognitive decline exhibited lower sleep efficiency, reduced inter-hemispheric functional connectivity during rapid eye movement (REM) sleep, and slower EEG rhythms during stage 2 non-REM sleep. While none of these measures passed as stand-alone features, the combined effects discriminated the two groups with an accuracy of 72% (sensitivity 75%, specificity 67%).

Conclusions: In conclusion, the study demonstrates the potential of combined sleep and electrophysiological measures as signs of cognitive changes. Ongoing medical screenings of the cohort are required to identify subjects progressing from cognitive decline to severe neurological disorders. These future investigations will need to confirm the demonstrated potential of sleep disruptions as strong indicators of a possible later development of a neurodegenerative disorder.

Disclosure: Nothing to disclose.

O195 | A polysomnographic sleep and resting state fMRI connectivity study in the general population

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Objectives/Introduction: With aging, sleep patterns change and sleep problems become more common in elderly persons. There is increasing evidence that impaired sleep is associated with structural brain characteristics, but less is known about the link with functional brain connectivity. We investigated the association of sleep with functional connectivity of the brain in an observational setting.

Methods: In 630 participants from the population-based Rotterdam Study we investigated cross-sectional associations of polysomnographic and subjective sleep aspects with resting-state functional connectivity during daytime. We investigated both resting-state correlations and BOLD-signal amplitude, on a global, network, and nodal level, defined by ICA. Analyses were adjusted for age, sex and other potential confounders.

Results: Longer total sleep time (TST) was associated with lower mean signal amplitude on a global brain level (Beta = –0.023, 95% CI –0.041; –0.004, $P_{FWE\text{-}corrected} = 0.01$). Regionally, this effect was driven by multiple resting-state networks and remained significant in the ventral attention network after correcting for multiple testing (Beta = –0.049, 95% CI –0.075; –0.023, $P_{FWE\text{-}corrected} = 0.001$). The effect of TST was mainly accounted for by shorter duration of rapid eye movement (REM) and N2 stages, but not stage N3. Moreover, this relation between longer TST and lower amplitude seemed particularly apparent in persons with good subjective sleep quality. We found no associations of sleep and resting-state correlations between and within networks, or between nodes.

Conclusions: In this cross-sectional, population-based study, longer TST was related to a lower amplitude of low-frequency fluctuations in BOLD-signal during daytime, in multiple resting-state networks. This relation is driven by stages N2 and REM, and extends beyond homeostatic, night-to-day effects. Sleep may facilitate the repertoire of low-frequency fluctuations during daytime, or, vice versa, daytime brain activity in the low-frequency range may influence (a need for) sleep.

Disclosure: Nothing to disclose.